

Atoms and Molecules

Notes

Learning Objective: In writing, SWBAT describe an atom and its particles, using academic language.

Metal

a kind of matter that is solid and shiny

Examples of metal

- gold
- iron
- copper

Nonmetal

a type of matter that does not have the properties of a metal

Examples of nonmetals

- oxygen
- calcium
- carbon
- sodium

Matter

is anything you can see, touch, taste, or smell

<http://www.brainpop.com/science/matterandchemistry/atoms/>

Atom

the smallest unit of matter

Three particles
in an atom

- proton
- neutron
- electron

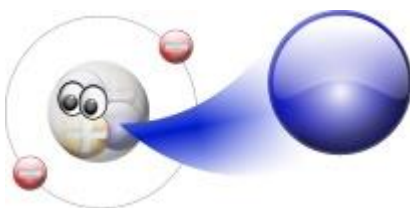
Proton

a tiny particle in an atom that has a positive electrical charge



Neutron

a tiny particle in an atom that has no electrical charge



Electron

a tiny particle in an atom that has a negative electrical charge



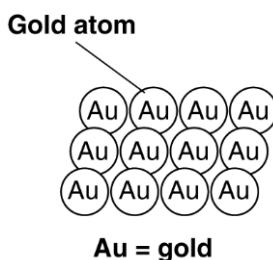
Learning Objective: In writing, SWBAT compare and contrast elements and molecules, and give examples of each, using academic language.

Element

matter that is made of only one kind of atom

All atoms of the same element are alike

Example: all atoms of gold are the same



The atoms of gold are different from atoms of other elements

All matter is made up of elements

There are 118 elements

Examples of elements

- oxygen
- gold
- hydrogen
- calcium

Molecule

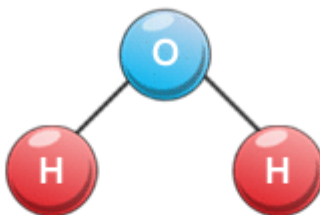
two or more atoms that are joined together

Some molecules are made of only one type of atom

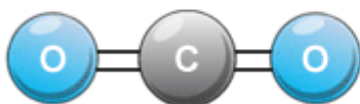
Examples of molecules

- oxygen gas (O_2)
- methane (CH_4)
- carbon dioxide (CO_2)
- water (H_2O)

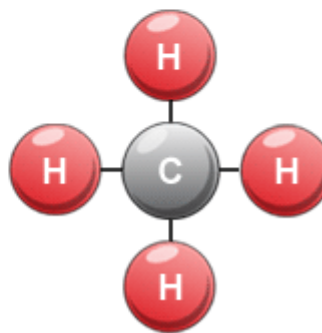
water



carbon dioxide



methane



Atoms and Molecules

Check Your Understanding

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1. How are gold and silver the same? How are they different?

Gold and silver are the same because they are both _____ and they are different because they are _____ .

2. Write the names of three kinds of matter you can easily see.

Three kinds of matter you can easily see are _____ , _____ , and _____ .

3. What is matter made of?

Matter is made of _____ .

4. What could you use to make a model of an atom?

To make a model of an atom, you could use _____ and _____ .

Learning Objective:

In writing, SWBAT describe the structure of an atom using academic language.

Nucleus

the center of the atom

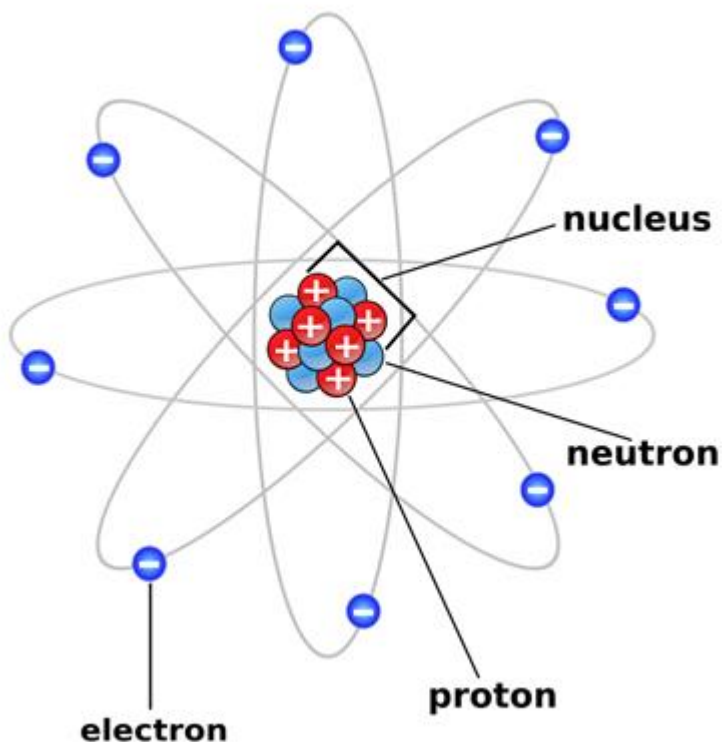
Protons and neutrons are located in the nucleus

Most of an atom's mass is in the nucleus

The nucleus has a positive charge

Electrons are located outside the nucleus

Atomic Structure



<http://www.brainpop.com/science/matterandchemistry/atomicmodel/>

Atoms and Molecules

Science Skill

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1. What do the labels on the diagram of the atom tell you?

The labels on the diagram of the atom tell you _____ .

2. What are the parts of an atom?

The parts of the atom are _____ , _____ , and _____ .

3. How many electrons does the atom have?

The atom has _____ electrons.

Learning Objective:

In writing, SWBAT examine the periodic table and describe the rules for element symbols using academic language.

Molecule

has different properties than the individual atoms in the molecule

Example: water molecule (H_2O)

Water is a liquid

Hydrogen and oxygen are gases

Periodic table

a table that organizes the elements

Periodic Table of the Elements

1
1H
1.0079

2
2He
4.00260

3
3Li
6.941

4
4Be
9.01218

11
11Na
22.989768

12
12Mg
24.305

19
19K
39.0983

20
20Ca
40.078

55
55Cs
132.90543

56
56Ba
137.327

87
87Fr
223.0197

88
88Ra
226.0254

13
13Al
26.981539

14
14Si
28.0855

15
15P
30.973762

16
16S
32.066

17
17Cl
35.4527

18
18Ar
39.948

31
31Ga
69.732

32
32Ge
72.64

33
33As
74.92159

34
34Se
78.96

35
35Br
79.904

36
36Kr
83.80

49
49In
114.818

50
50Sn
118.71

51
51Sb
121.760

52
52Te
127.6

53
53I
126.90447

54
54Xe
131.29

81
81Tl
204.3833

82
82Pb
207.2

83
83Bi
208.98037

84
84Po
[208.9824]

85
85At
209.9871

86
86Rn
222.0176

113
113Uut
unknown

114
114Uuq
[289]

115
115Uup
unknown

116
116Uuh
[298]

117
117Uus
unknown

118
118Uuo
unknown

21
21Sc
44.95591

22
22Ti
47.88

23
23V
50.9415

24
24Cr
51.9961

25
25Mn
54.938

26
26Fe
55.847

27
27Co
58.9332

28
28Ni
58.6934

29
29Cu
63.546

30
30Zn
65.39

39
39Y
88.90585

40
40Zr
91.224

41
41Nb
92.90638

42
42Mo
95.94

43
43Tc
98.9072

44
44Ru
101.07

45
45Rh
102.9055

46
46Pd
106.42

47
47Ag
107.8662

48
48Cd
112.411

72
72Hf
178.49

73
73Ta
180.9479

74
74W
183.85

75
75Re
186.207

76
76Os
190.23

77
77Ir
192.22

78
78Pt
195.08

79
79Au
196.9665

80
80Hg
200.59

104
104Rf
[261]

105
105Db
[262]

106
106Sg
[266]

107
107Bh
[264]

108
108Hs
[269]

109
109Mt
[268]

110
110Ds
[269]

111
111Rg
[272]

112
112Cn
[277]

57
57La
138.9055

58
58Ce
140.115

59
59Pr
140.90765

60
60Nd
144.24

61
61Pm
144.9127

62
62Sm
150.36

63
63Eu
151.9655

64
64Gd
157.25

65
65Tb
158.92534

66
66Dy
162.50

67
67Ho
164.93032

68
68Er
167.26

69
69Tm
168.93421

70
70Yb
173.04

71
71Lu
174.967

89
89Ac
227.0278

90
90Th
232.0381

91
91Pa
231.03588

92
92U
238.0289

93
93Np
237.0482

94
94Pu
244.0642

95
95Am
243.0614

96
96Cm
247.0703

97
97Bk
247.0703

98
98Cf
251.0766

99
99Es
[254]

100
100Fm
257.0851

101
101Md
258.1

102
102No
259.1009

103
103Lr
[262]

Alkali Metal

Alkaline Earth

Transition Metal

Basic Metal

Semimetals

Nonmetals

Halogens

Noble Gas

Lanthanides

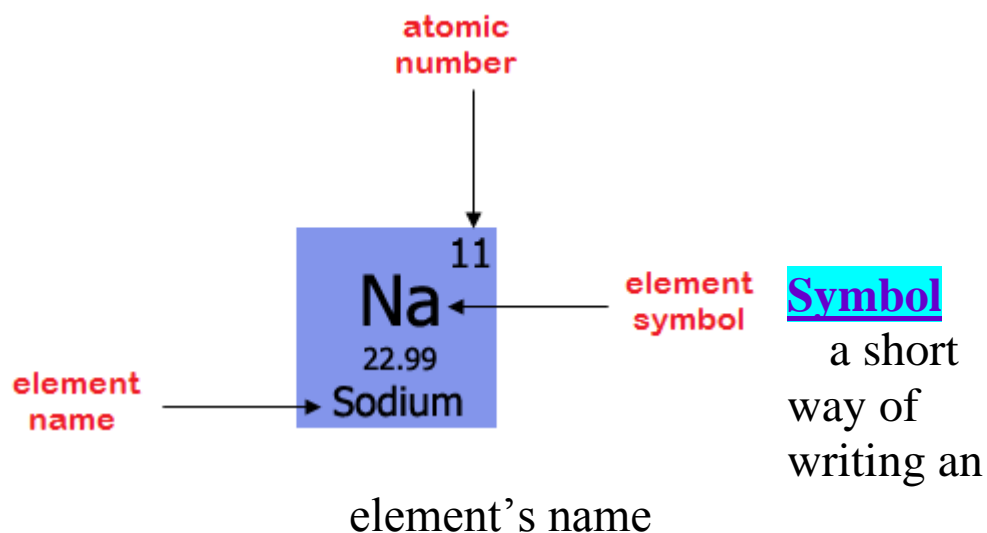
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Periodic Table of the Elements

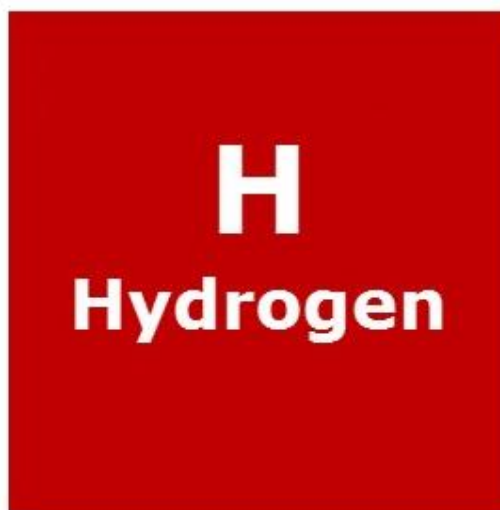
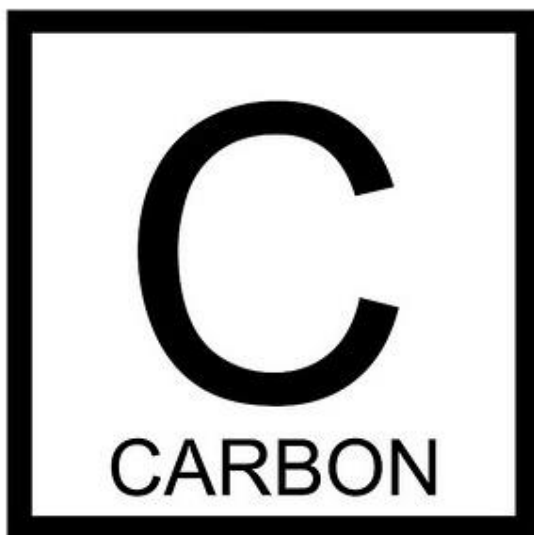
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VIII
8A

Elements in the periodic table are organized by their properties

Each box in the periodic table has information about an element



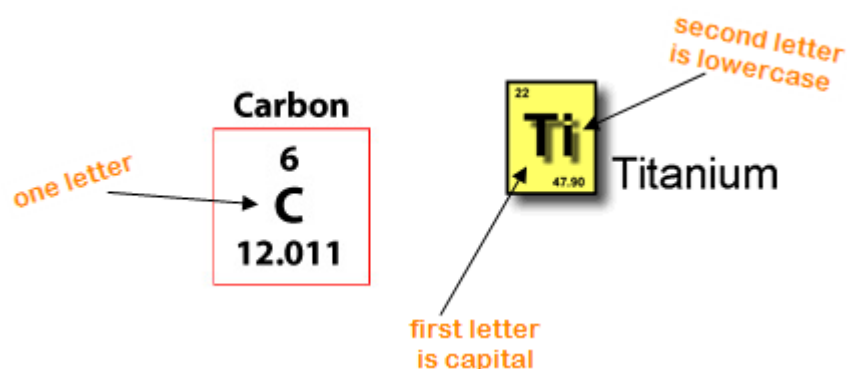
Symbols are created from the name of each element



Rules for symbols

- all of the symbols have either one or two letters
- the first letter of each symbol is a capital letter

- if the symbol has a second letter, the second letter is a lowercase letter
- there is no period at the end of a symbol



Examples of
symbols

- O (oxygen)
- Ag (silver)
- Cl (chlorine)

Learning Objective: In writing, SWBAT explain atomic number and determine the atomic number of any element, using academic language.

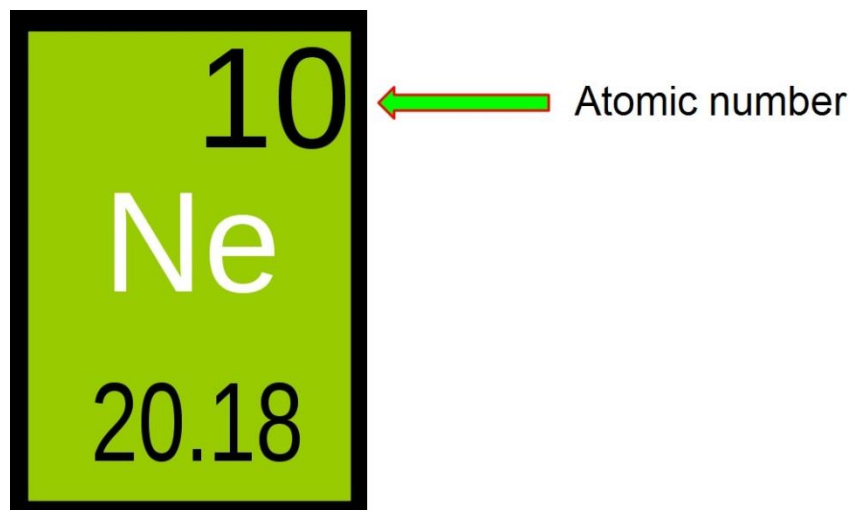
Atomic number

the number of protons in the nucleus of an atom

No two elements have the same atomic number

The atomic number of an element never changes

The number of protons in the nucleus identifies the element

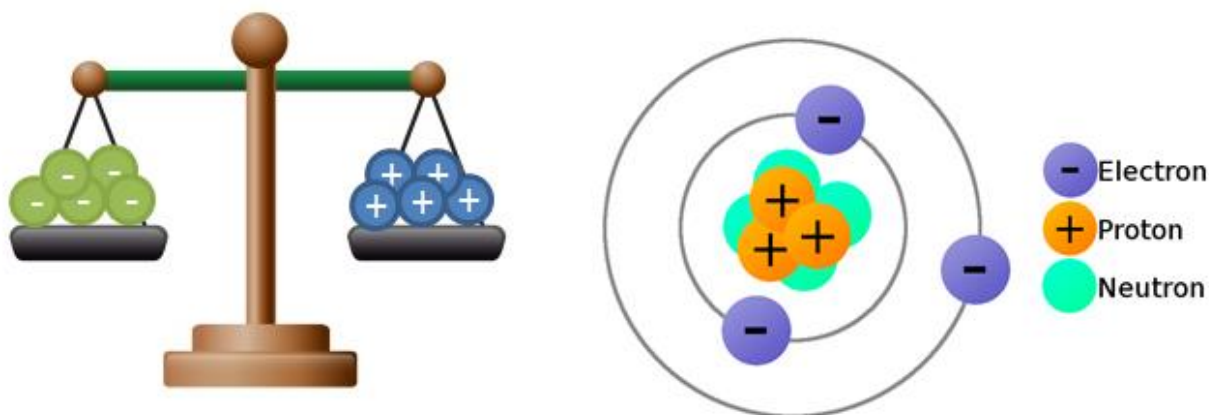


<http://www.brainpop.com/science/matterandchemistry/periodictableofelements/>

Learning Objective: In writing, SWBAT relate an element's atomic number to its electrical charge, and determine the charge of different ions, using academic language.

Atoms have a neutral charge

the number of protons is the same as the number of electrons



Ion

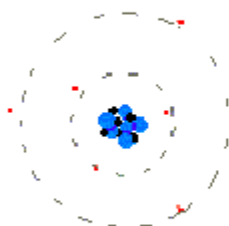
an atom with an electrical charge

Forms when an atom gains or loses an electron



This Atom is Neutral

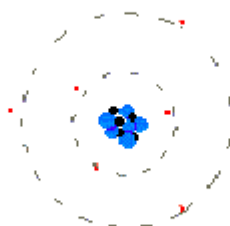
Same number of protons and electrons



- 6 Protons
- 6 Neutrons
- 6 Electrons

This Atom is Negatively Charged

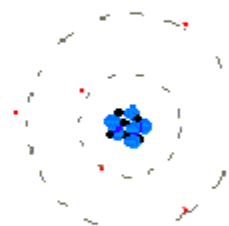
More electrons than protons



- 5 Protons
- 6 Neutrons
- 6 Electrons

This Atom is Positively Charged

More protons than electrons

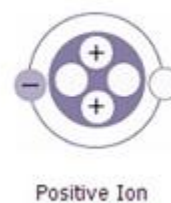
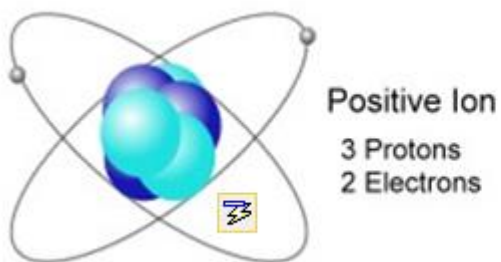


- 6 Protons
- 6 Neutrons
- 5 Electrons

Cation

an ion with a positive charge

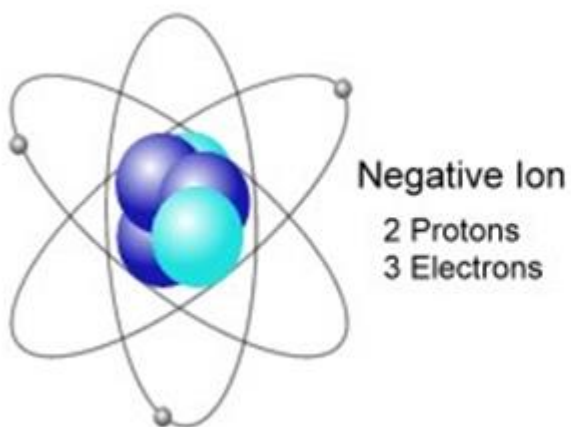
It forms when an atom loses electrons

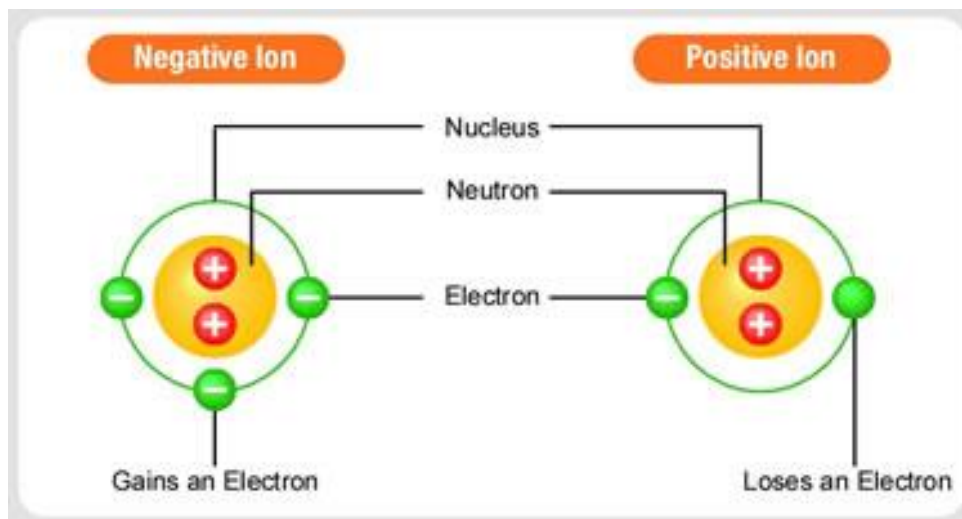


Anion

an ion with a negative charge

It forms when an atom gains electrons



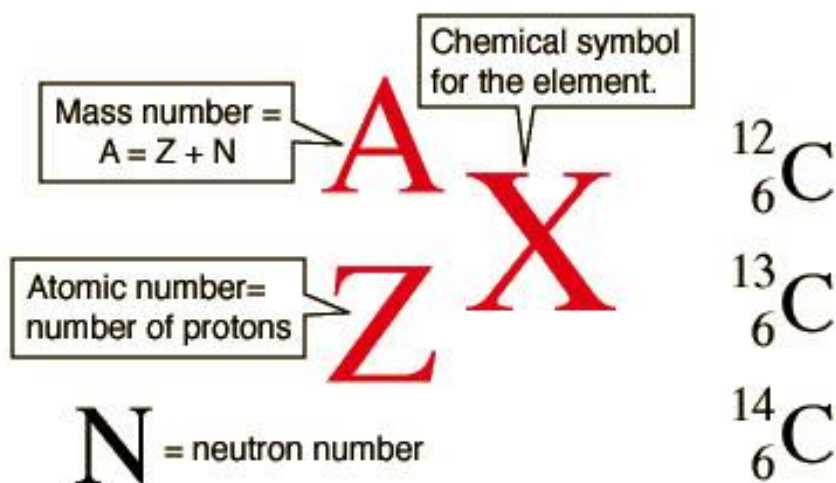


<http://www.brainpop.com/science/matterandchemistry/ions/>

Learning Objective: In writing, SWBAT define mass number, and use that knowledge to calculate the number of neutrons in an atom, using academic language.

Mass number

the number of protons plus the number of neutrons in an atom



$$\text{mass number} = \text{number of neutrons} + \text{atomic number}$$

Number of neutrons

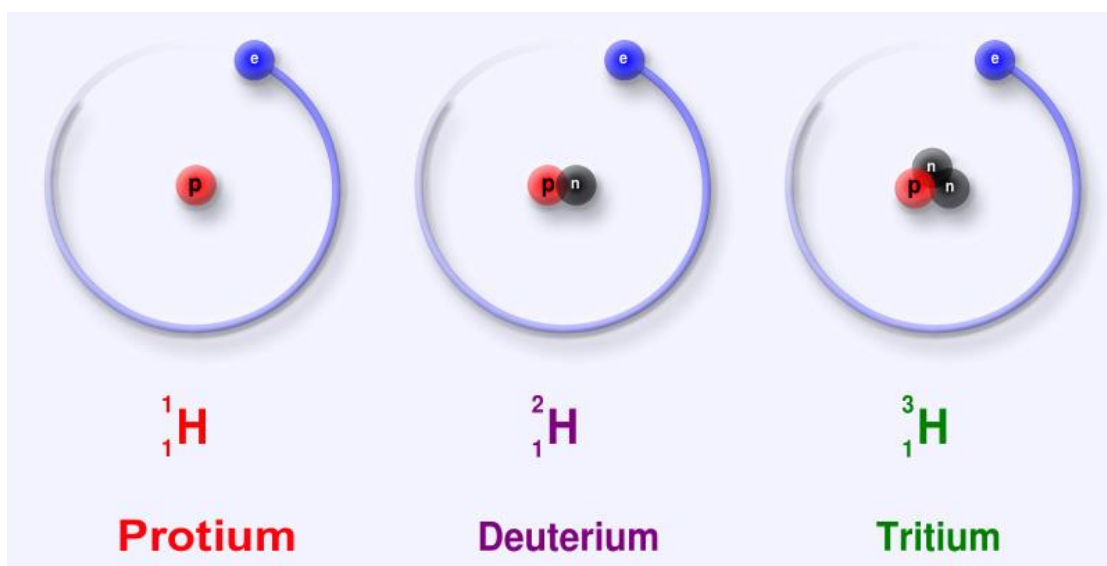
if you know the atomic number and the mass number of an element, you can find the number of neutrons in an atom

$$\text{number of neutrons} = \text{mass number} - \text{atomic number}$$

Isotope

an atom of an element with the same number of protons and different numbers of neutrons

All elements have two or more isotopes



Atoms and Molecules

Check Your Understanding

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1. What electrical charge does a proton have?

A protons has a _____ charge.

2. What elements combine to form a water molecule?

The elements that combine to form a water molecule are _____ and _____ .

3. What does the periodic table do?

The periodic table _____ .

4. What does the atomic number of silver tell you about silver?

The atomic number of silver tells you that silver has _____ .